ANALYSIS OF REQUIREMENTS FOR DIGITAL TOOLS INTEGRATION – DIDACTIC FRAMEWORK AND MEASUREMENT PROTOCOL

HOTEL ACADEMY

Deliverable D1.1-5 – Version 1

Type of Activity			
IO	Intellectual Output		**X**
A	Project Management and Implementation		
M	Transnational Project Meeting		
E	Multiplier Event		

Nature of the deliverable		
	Feedback from participants	
	Direct effect on participants and project partners	
	Practical & reusable resources for the practitioners	
	Research material bringing forward the reflexion in the sector	**X**
	Community building tools	
	Partnerships and Cooperation	
	Dissemination material	
	Organizational and working documents	

Dissemination Level			
PU	Public		**X**
CO	Confidential, only for members of the consortium (including the Commission Services)		

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List of participants

Participant No*	Participant organisation name	Acronym	Country
1 (coord)	Manzavision	MZV	France
2	MBA ESG	ESG	France
3	European University Cyprus	EUC	Cyprus
4	Fachhochschule Dresden	FHD	Germany

CONTENT

This Report on IO1 by Fachhochschule Dresden (FHD)
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Abbreviations

CS: Case Studies

ECTS: European Credit Transfer System

GBL: Game Based learning

LMS: Learning Management System

ML: Mobile Learning

QoE: Quality of Experience

UEQ: User Experience Questionnaire

UX: User eXperience

VET: Vocational Education and Training

VCL: Virtual Collaborative Learning

VR: Virtual Reality

VRL: Virtual Reality Learning

1 INTRODUCTION

The **Hotel Academy** project is based on the development of a cross-national educational scenario for hospitality management through the use of modern educational technologies. The IO1 is the conceptual basis for the pedagogical scenario. With the development of a didactic framework, the potentials and risks of the used educational technologies are analysed and brought together in the form of heuristics. The didactic framework is a working tool of the project, which condenses design recommendations and is continuously developed during the project. As such, this is the first version of the report, an updated version may be delivered on the course of the project. It also includes the practical experience gained with the respective educational technologies and thus facilitates the transfer of science and practice within the Hotel Academy project and beyond.

With this work report, the results from the work package IO1, Analysis of requirements for digital tools integration - didactic framework and measurement protocol, are documented:

- O1.1 Literature Review, Learning in Virtual Reality
- O1.2 Literature Review, Mobile Learning
- O1.3 Requirements of Context
- O1.4 Didactic Framework
- O1.5 Measurement Protocol

Since activities O1.1 and O1.2 are based on a uniform research strategy, the methodology of literature analysis and knowledge generation will be described in detail below and the results of all activities will be outlined based on this.

2 LITERATURE REVIEW – RESEARCH PROCESS

For the O1.1 and O1.2 first a systematic literature review has been conducted. In total 27 highly relevant papers regarding VR Learning and 32 papers regarding Mobile Learning were examined through digital academic access, such as SLUB (TU Dresden), Regensburger Katalog plus (University Regensburg), academia.edu, google+ and google academics. Each paper was read in total, resulting in 23 different key words, later 14 essential different key words (i.e. "collaborative working, "teaching", "education" or technical-didactic key words, such as "immersion", "digital natives", "HMD" etc.). In the end 17 papers on each subject – VRL (Virtual Reality Learning) and ML (Mobile Learning) – built the essence of the contents regarding our presentation, delivering maximum overlaps with all most relevant key words. One half of these papers delivered specific individual findings and own characteristic results/theses. The other half (around 7 to 10) delivered maximum overlap in relevant findings with the other papers. Most overlap was empirically conducted to most highly relevant regarding meta-(meta-)analysis process of the literature research.

This specific information was then built within the scheme based on Euler & Seufert (2005) to create a representative model of information, and category-based content analysis. Both researchers have developed a framework for usage and integration of E-learning innovations in educational organisation. Following the main idea of the framework, educational managers have to balance out risks and potentials of E-learning innovations in five different dimensions:

(a) <u>Didactics</u>: learning process, curriculum, tutoring, learning outcome, instructional design
(b) <u>Technology</u>: standards, infrastructure, tools & systems, interfaces, data security
(c) <u>Organisation</u>: quality, assistance & support, administration, organisational development, rules
(d) <u>Economy</u>: benefits, costs, business model, financial risks, sustainability
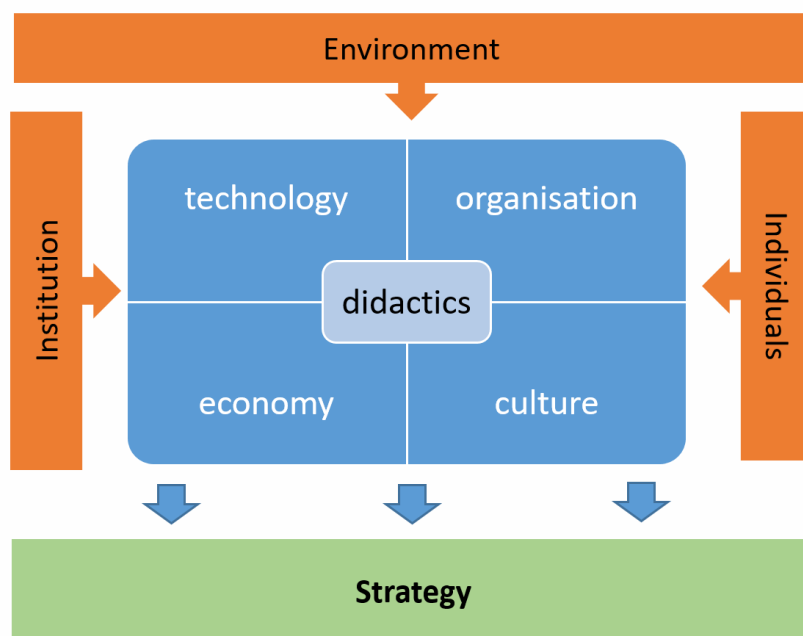(e) <u>Culture</u>: habits, learning- & teaching culture, acceptance, communication

Figure 1: Framework for implementation of E-Learning innovation (Euler D., Seufert S. 2005, Change Management in Higher Education: Implementation of e-Learning as a Sustainable Innovation)

The framework works as holistic system, if you separate/isolate parts of information out of it, this can be managed for specific further explanation but generally it has to stay connected to the rest of information within the framework. But for decisive findings and information a way of categorization is inevitable. Following this way of examination, the categorization is itemized and the findings are explored deeper. For the presentation within the Transnational Meeting and this specific report an amount of information of ~55 pages of text (results), was first summarized to ~23 pages, and then plotted into each framework (VRL and ML) for each 7-8 pages in tabular form. Here, three different structural guidelines helped to make the final results clearly arranged: (1) chances/potential, (2) risks/challenges, and (3) (more or less neutral) implications, which proved to be highly characteristic. About 1 ½ pages of tabularly text then resolved in 3-5 central key points for the presentation, which can be found in the following (membered "i.", "ii.", and so on).

3   O1.1 GUIDELINES FOR VIRTUAL REALITY LEARNING (VRL)

Based on Literature Review the scientific *status quo* regarding the requirements of VR elements in educational scenarios was analysed. The research includes in particular:

- Studies on the design and effectiveness of VR sessions in education.
- Studies and experience on the use of VR in the in the classroom as well as workplace learning.
- Best practice on VR-based education scenarios in Vocational Education and Training (VET), especially in tourism and hospitality management.
- Studies regarding the incorporation of Learning Objects in VR environments, the design of additional didactic elements as well as incorporation of VR-based scenarios into teaching or learning scenarios in classroom or work-processes.
- Studies regarding the combination of Virtual Reality learning with other learning modalities, including Mobile Learning (ML).

Following the five dimensions as pointed out in chapter 2 (Euler & Seufert, 2005) are presented in their essence:

a. **Didactics**
 i. VRL supports the development of social skills by integrating the VR setting into social learning arrangements (e.g. group learning, role playing). Embedding of VRL scenarios in educational game situations (GBL) promotes positive learning effects. VRL promotes attention, motivation, concentration and presence and immediacy.
 ii. VR scenarios should only be used selectively in the learning process (10-15 mins).
 iii. In addition to the generally possible improvement of the learning environment, the cooperation among students is promoted, as well as between students and teachers.
 iv. Group work and individual sessions are possible depending on requirements → Group work: motor skills, interaction and behaviour are trained. → Single sessions: promote explicit learning success (in the sense of correct results).
 v. VRL requires instructions and didactic interventions (e.g. virtual agents) to counteract distraction and cognitive overload.

b. **Technology**
 i. The use of wireless VR technologies and fit-for-purpose headsets prevents physical impairments and motion sickness. The physical environment is also crucial (e.g. space for movement).
 ii. The production of VR scenarios requires special programming and design skills and is therefore resource intensive. Strong division of labour and participation of technical and design experts.
 iii. Technology is susceptible to faults. Positive effects with VRL depend on the equipment. Therefore, VRL scenarios should be accompanied by technological and didactic support offers or tested intensively in advance.
 iv. The interaction in the VR scenario is difficult and requires training (e.g. controllers). In the coming years, an increase in design possibilities for interaction in virtual space, e.g. through gesture-based control, can be expected. In the didactic planning these restrictions have to be considered, for example by giving learners time to "get used" to forms of interaction.

c. **Organisation**
 i. Goal: compatibility between new individual VR technology (headset, software) and the existing technological infrastructure (faculty, university).
 ii. Permanent coordination between the universities' internal IT and project-related special technology, e.g. WLAN network performance.
 iii. Teachers need assistance in the form of didactic support, for example, through handouts or recommendations for the integration of VR.
 iv. A basic organisational problem is the compatibility of the global production policy of individual VR companies with the regional education policy of universities; here, an organisation plan/ organisational concepts/ VR-specific organisation strategies must be drawn up by the university(ies) for each individual establishment of VRLEs (among other things taking into account data protection aspects).
 v. Project management in the VRL is very complex, as many different professions are involved (IT, educators, designers, data privacy security, device manufacturers, etc.). VR experts with interdisciplinary knowledge in the different professions to manage these projects.

d. **Economy**
  i.   In general, VR technology is much more affordable than a few years ago. Even high quality models cost only a fraction of their former price (price reduction in the last 5-7 years: about 70%).
  ii. In principle, the initial investment of VR technology at individual universities is the biggest challenge. Once established, costs can even be saved thanks to VR, but this is not yet sufficiently empirically proven, as we are still in the early stages of this process. In general, the biggest challenge – also in terms of time and money – is the targeted training of teachers and students.
  iii. VR technologies bring economic advantages through problem-free repeatability if the intended learning goals in presence formats (before their simulation through VR) mainly could be achieved under difficult conditions, e.g. in laboratory experiments or medical and technical disciplines, and if learners learn spatially separated from each other.

e. **Culture**
  i.   In recent years, VR has been used increasingly in scientific (medicine, anatomy, geology), mathematical and technical (engineering) disciplines by mapping/ simulating complex but systematic processes. Social science research fields are present, but still in the early stages of immersive VR applications.
  ii. While younger students are mostly positive about VR, older teachers often have difficulties with it. The biggest challenge here is to question old patterns of thinking and teaching and to implement VR into pedagogical processes in a goal-oriented way and to accompany this during the implementation.
  iii. New learning paradigm: "From Teaching to Learning"
  iv. In addition, individual health aspects must be taken into account; otherwise, the symptoms of excessive use of VR Apps per day and week are counterproductive to motivation and learning success.
  v.   In intercultural VR scenarios, the respective teaching and learning cultures have to be taken into account, both with regard to the instructional design and the visual design within the VR scenario, as well as the embedding in the curriculum.

4 O1.2 GUIDELINES FOR MOBILE LEARNING (ML)

Based on Literature Review the scientific *status quo* regarding the requirements of Mobile Learning (ML) was analysed. The research includes in particular:

- Studies on the design and effectiveness of Mobile Learning
- Studies and experience on the use of mobile in the classroom as well as workplace learning
- Best practice on mobile learning in VET, especially in tourism and hospitality management.
- Studies regarding the combination of mobile learning with other learning modalities, including Virtual Reality learning

Following the five dimensions as pointed out in chapter 2 are presented in their essence:

a. **Didactics**
  i.   The function of ML as micro learning is formative. On the one hand, this can be "formal", i.e. integrated into the classroom (online lecture or classroom), but also increasingly for supplementation, preparation and follow-up in the "informal" sense, i.e. outside the classroom.

ii. ML perfect as a supplement to the actual lessons and as an extension of the learning content. ML offers immediacy and evokes attention.

iii. Sophisticated didactic concept necessary, without which ML would be lost as a goal-oriented concept. Carefully structured curricula make the difference, with mobile apps integrating a serious content level into the overall pedagogical concept (e.g. through GBL).

iv. "Orchestration" or "Learning Management System (LMS)", where knowledge verification, learning transfer and knowledge sharing are well coordinated. Location-independent, fast access offers supplementary information to the actual learning content, small tests or quizzes with compact text formats.

b. Technology

i. Relevant advantage: enormous technological development in recent years. Smartphones, which most people use privately, are their own microcomputers with a variety of functions.

ii. The simple operation and easy transportability of smartphones as mobile end devices are particularly in the spotlight (see PDA, laptop, tablet PC). The greatest advantage is flexibility and mobility (learning independent of location), but only if the Internet connection is stable at the respective locations.

iii. A visible disadvantage are the relatively small screens, which cannot display larger learning fields or rooms in a meaningful digital way. Therefore, the focus is on compact learning content that unfolds on the screen as the images change.

iv. Numerous different operating systems cause compatibility problems between the individual apps and contents, which makes a didactic teaching and learning concept more difficult (certain security – 70% – with iPhone-oriented smartphones and android-based operating systems).

c. Organisation

i. Organisation of ML is especially challenging in the preparation, because it is necessary to check which user has which requirements (device, operating system). This quite elaborate individual consideration stems from the economic simplification "Bring your own device".

ii. "Orchestration", beyond pure didactics, can be transferred to the necessary organisation of ML: Orchestration is an ongoing process.

iii. The objective is called "seamless learning/ navigation", considering a) multiple mobile devices, b) compatibility and permanent technical updates, and c) data security.

iv. Advantage: Easy creation of learning content via authoring systems ("author ware") in ML contexts.

d. Economy

i. "Bring your own device" (BYOD)

ii. Specific costs are merely a factor with ML (as it is more with VR technology), since almost everybody has at least 1-2 devices and therefore is common with the mobile app technology

iii. These obvious savings of money regarding Mobile Learning/devices should consequently be put into quality work by persons, i.e. improvement of organisational, educational embedding of mobile apps, and the full development of curricula and pedagogical issues

e. Culture

i. The biggest chances lie in the motivating nature of ML apps and especially the students' general positive attitude towards it. On the other hand, (older) teachers still frequently doubt the new technology. This generation conflict must be overcome and a goal-oriented cooperation created.

ii. This is done by means of the increased promotion of learning processes instead of teaching processes, especially with regard to teachers. It is important in terms of learning culture

that students are instructed with regard to independent learning (self-learning competence) and that the over-potential of breaking down the boundaries of ML is sensibly curbed.

iii. ML is ideally suited for the promotion of "21st century competencies" (e.g. self-reflective learning). However, the planned ML time units should be kept compact, since excessive connectivity, especially by students, is judged negatively (preservation of PI - Personal Identity).

iv. Even "technologically savvy" students can struggle with certain mobile apps if they are designed too complicated. In any case permanent training on both sides (teachers and students) is necessary.

5 EXCURSION: VIRTUAL COLLABORATIVE LEARNING (VCL)

With the project Hotel Academy, a cross-institutional curriculum in the field of hospitality management will be developed. A key element of the educational offer is the cooperation of students from three different European countries and universities. This collaboration is to be implemented using virtual collaborative learning (VCL). Because of the importance of VCL for the project this concept has been put into focus.

VCL arrangements help to transfer group lessons into the virtual space. (1) A high level of self-organisation is required within the group of students, as all members of the group are responsible for their joint work results. (2) The students work on authentic business cases with clear practical relevance for a short time period of usually six weeks. Due to their blended learning character VCL-scenarios consist of the three phases of knowledge acquisition, virtual group work, and assessment. In order to enable working interdisciplinary and multi-perspectival, the students have to adopt different roles, which are often related to their interdisciplinary study programmes. (3) For their exchange and process documentation, participants use social networking software and digital communication tools. Learners are supported in their collaboration by qualified e-tutors to maximise both individual and group learning outcomes. (4) VCL focuses on learning outcomes, such as intercultural awareness, the ability to collaborate, the purposeful use of social networking tools and case study work, and offers students from all participating locations after successful completion of the course adequate ECTS (European Credit Transfer System) credits and grades based on formative and summative assessments (Black & Wiliam, 1998).

As part of this work package, the pedagogical potential of VCL scenarios was examined on basis of three case studies and success factors for the VCL in the Hotel Academy project were derived from this.

The following Case Studies (CS) have been successfully conducted and can be regarded as best practice examples for the Hotel Academy:

- A VCL course as a bi-national joint project between TU Dresden and Shiraz University. The project is hosted by the chair of Information Management at TU Dresden and formally anchored in the master's degree program of Business Administration in the summer semester 2019.
- The VCL course of case 1 was additionally offered again but in cooperation with two universities in Germany. One student group was from the master's degree program "Further Education Research and Organisational Development" of the Dresden University of Technology and the other group was from bachelor's degree program "Media Communication" of Chemnitz University of Technology. Both groups of students pursued their study in the fields of educational management and instructional design.
- CS 3 was held in Germany as part of a cross-university cooperation between the business and economics faculties at the "Dresden University of Technology" (TU Dresden), as a full university, and at the "Hochschule für Technik und Wirtschaft" (HTW) Dresden, as a university of applied sciences. This sample of students consists of Bachelor and Diploma students and was sufficiently interdisciplinary.

Relevant Factors for conducting VCL in Hotel Academy

In order to integrate VCL into the Hotel Academy educational program we need to expand the analysis and review of literature and best practices to a framework that specifically focuses on the macro and micro level:

The macro level reflects the field of institutional planning, e.g.

- The curriculum determines how the VCL should be integrated into the regular study program. The curricular conditions, especially course objectives and module descriptions (qualification objectives, course contents, ECTS, Workload) must therefore be in conformity with the planned scenario.
- Study groups reflect different cultural characteristics, with respect to nationalities, higher education culture and subject culture. Cultural differences between partners institutions is understood as a fruitful resource for all partners, as this promotes diversity and sensitises for intercultural communication, but they could also harbour potential for conflict, if different demands for the teaching methods collide.
- The educational technology defines the technological framework with which university collaborations can be implemented via VCL.

On micro level the following factors are relevant:

- A basic prerequisite for the success of the cross-university virtual group work is the accompaniment by e-tutors. E-tutors are the link between learners and teachers and are prepared for their specific needs of online group work.
- The learning objectives and evaluation criteria of virtual group work must be defined between the parties involved and communicated to the students. Already agreeing on common learning goals is challenging because courses are usually embedded in study modules, whose qualification objectives often differ significantly.
- The selection of topic and assignments, which are relevant and interesting for the students is the core of VCL scenarios. The topics must be practical, realistic, and realisable, and focused on the future working field of students.
- The implementation of VCL requires the strong engagement of the students on different levels. On one hand, they have to achieve the best possible result (learning outcome). On the other hand, VCL also requires strong involvement in the group work process, for example, by assuming responsibility for special tasks (e.g. coordination, documentation).
- The students have to practice the interaction in virtual group work to succeed. Assistance and clearly communicated requirements are just as necessary as regular formative feedback.
- Learning Analytics facilitate formative feedback. A meaningful assessment of learning processes and learning outcomes for virtual settings should be enhanced by "hard", fixed, automatically measurable, quantitative indicators.

Based on these findings, the development of VCL-based courses or programs is more oriented towards educational potentials. In general, the use of technology in learning scenarios needs to be discussed more intensively from a didactic perspective. The present findings are therefore part of a project-specific didactic framework that enables this.

6 O1.3 REQUIREMENTS OF CONTEXT

In addition to the literature analysis above, we also conducted an analysis of the specific needs and requirements for classroom training in Hospitality and Tourism Management. Based on group discussions of all partners in online- and offline meetings during the first six month of the project, we refined the requirements of the educational situation in order to specify the institutional and subject-specific conditions of the trainings in Hospitality Management to be piloted at all partner institutions within this project.

This primarily includes an analysis of the educational context and the specifics of Hospitality Management. In the following Table 1, we summarize those requirements: students' economic situation; university-specific duration of the academic year; lecture weeks; students' cultural/national background; students' age/gender/quantity per year; level of students' degree program; learning method, experiences in new technologies.

Table 1: Requirements of the partner universities and educational context

Requirements	Partner Universities / Educational Context		
	EUC (Cyprus)	**FHD** (Germany)	**ESG** (France)
Students' economic situation	Mix of students of wealthy families, e.g. of hotel owners, and from middle class families who pursue a management career	Students from middle class; tuition fees are paid not only by family, grants, employer	Degree students: tuition is paid by the state; apprenticeship paid by their company
Duration of Academic year	Fall: Sep-Jan Spring: Jan-May Summer: May-Jul	Winter: Oct-Feb Summer: Mar-Jul	Fall: Sep-Dec Winter: Jan Spring: Feb-May Summer-Fall: May-Sep
Lecture weeks	13 weeks per Semester (3 hours per week) + 2 weeks for registration/examination	13 weeks per Semester + 2 weeks project/examination week	10 months intensive, 1 week per month in school from Tue to Sat
Students cultural origins	Greeks from the islands, few from Middle East (Jordan), China, Ukraine, Croatia	mainly from Germany, few internationals	French, Chinese, European students (10% work abroad-outside Europe)
Students' age	18 to 22	18 to 21	23 to 26
Students gender	50:50 male/female	More women	55:45 female/male
Students quantity	25-30 per class/year	25-35 per class/year	20-45 per class/year (up to 5 classes)
Prepared Level of students' degree program	Mainly Bachelor, a few VET	Bachelor	Master with at least a bachelor's degree and 1-year experience
Learning methods	Mainly lectures and seminar format, in 2nd-3rd year combination of individual and group work, 3rd year BA thesis in small groups about operation, strategic and practical issues	Lectures, seminar, practice projects, excursions, individual and group work, 3rd year individual or group BA thesis about operation, strategic and practical issues	Lectures, seminar, 12 exams, Group work Business cases (Cesim) MA in strategic, worldwide contexts (e.g. Accor)
Duration of the Program	4 years	3 years	2 years
Experiences in new technologies	No, Project is an innovation	Yes	Yes

In addition, we also analysed criteria-based the information required to develop not only the didactic framework but also the educational context in order to match the different university and academic cultures of the partner institutions, with the help of the tool Activity Outline. The following Table 2 presents the results of the training requirements. All the cells highlighted in green represent the common sense in the discussions between all the partners.

Table 2: Requirements of classroom training

ACTIVITY OUTLINE			HOTEL ACADEMY
Please indicate the information required to define your activity:			
Type	Analogue	Digital	Both
Duration	1 hour	2 hours	3 hours/week (in average) • EUC: 13 + 2 weeks per Semester (3 hours per week) • ESG: 1 week per month for whole year • FHD: 13 + 2 weeks per Semester (3 hours per week)
Frequency	Once a week	Twice a week	Three times a week
Period of entire course	1 month	2 months	6 months
Term	Between February and May (spring term) would be ideal for all partners		
Number of players	Single	Small group (2-4)	Medium Group (5-12)	Whole class • EUC: <=35 (one class) • ESG: 20-45 (5 classes possible) • FHD: 20-25 (one class)
Target Group	ESG Students	EUC Students	FHD Students
Level	Bachelor 3rd year (FHD/EUC)	Bachelor 4th year (EUC)	Master 1st year (ESG)	Master 2nd year
Attendance	Compulsory		Voluntary
Assessment	Examinations	Assignments	Participation	None
Tools required	Replica / Role Play	Mobile (as a potential extension in further implementations)	VR	Others: Virtual Group Work Flipped Classroom Virtual Conference E-Lectures

(Note: the Number of players, Level, Assessment, and Tools required rows contain four columns.)

				Single Learning Exercises Offline Material
Learning objective	Repetition	Acquiring new knowledge	Putting knowledge into practice & Other Objective	
Teaching method	Face-to-face		Online	
Language of instruction	English	French	German	Greek

Course Purpose **and Objectives**	• The primary focus will be on the hotel/hospitality industry. • In this training, we are going to use different learning and teaching tools, methods and techniques. Furthermore, the course will also integrate peer learning since students have different experience levels in order to share their knowledge. • The training will especially focus on practical skills and competences. • The training integrates a role play.
Requirements / Needs from students	• ESG: Students want to experience and be trained with the VR experience; they will be involved in and be presented with behind the scene. • EUC: Students could be concerned about their privacy and security issues during the virtual collaboration. • FHD: We need to discuss the demographics regarding the (intercultural) audience. Learning processes are structured in 3 stages: presentation of knowledge existence, practice and performance.
Learning Outcomes	• Key challenges in hotel, tourism and event management • Explain developments • Evaluate strengths / weaknesses (+analysis) • Analytical + Presentation skills • Assess technology and management
Course contents	Cases that will be integrated in the training through role plays are: • Diversity Swap – A change of perspective • Cybersecurity • Key Account Management with focus on negotiation
Learning Design (parameters only)	• In-class activities will include at least at the beginning introduction of students to this specific training and explanation of relevant topics (1/3 in-class) • Practical exercises should be included • Use of VR-Technology will be incorporated in the role play.

7 O1.4 Documentation of initial didactic framework for Mobile Learning and VR Learning

The didactic framework is an instrument of didactic planning. It supports educational staff in the best possible way to interlink the individual components of a technology-based curriculum. For this purpose, the individual digitally supported educational formats are analysed, their suitability and characteristics identified and their potentials for the respective purpose compared.

According to the original project outline, the Hotel Academy project should develop teaching and learning scenarios with which students can develop relevant hospitality management knowledge in practical phases in the hotel sector. The format of work-based learning, which is characterized by the fusion of learning and work processes, is intended for this. With the project implementation there was a slight shift in the project goals. Now the development of a cooperative, transnational teaching scenario is planned, which is fully integrated into the curriculum in the study phases. But not in practical phases. There is currently no need for work-based learning. Subtasks of this work package that deal with the subject of work-based learning have been neglected.

This specifically defined didactic framework represents all the results and contents of the literature analysis in punctual form – the other way around the literature analysis with the specific results on VRL and ML with the five dimensions works as a caption for this didactic framework, with "a.i" to "e.iv" representing the essential content of the guidelines.
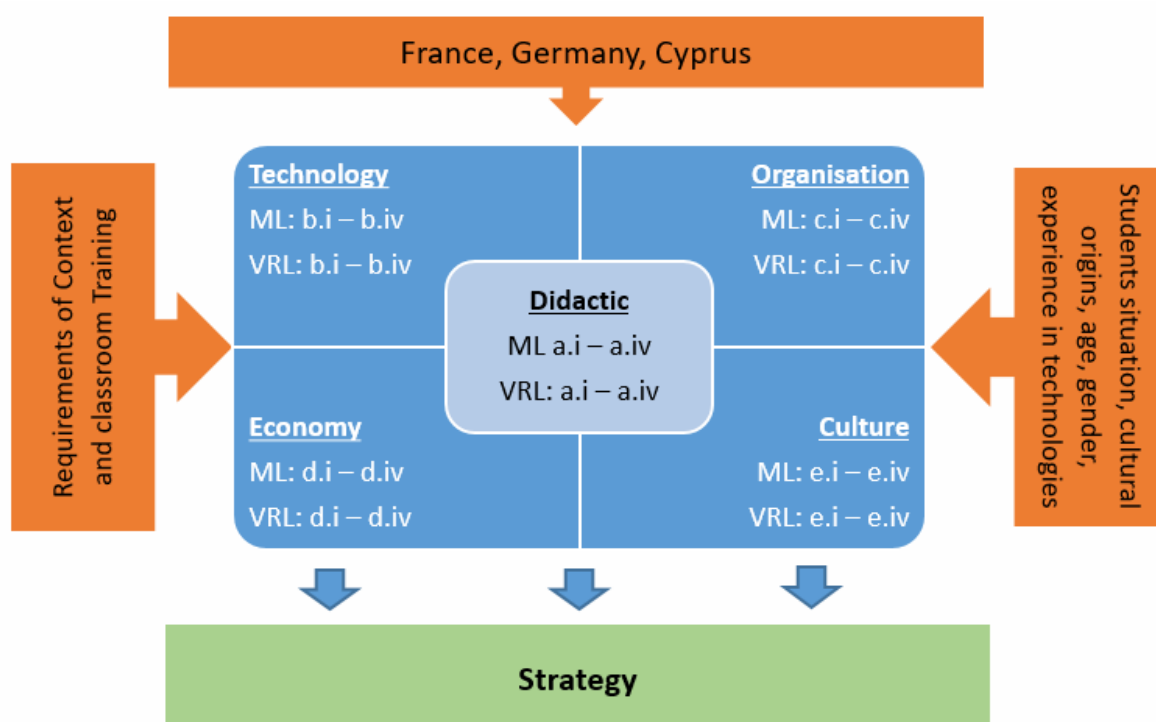
Figure 2: Didactic Framework for Hotel Academy including heuristics for using Mobile Learning (ML) and VR Learning (VRL)

8 O1.5 DOCUMENTATION OF MEASUREMENT PROTOCOL

For the development of a research strategy to test the suitability and effectiveness of the provided learning tools and to validate the didactic framework of reference, we will combine a variety of tools to develop a research strategy providing a measurement protocol. This will integrate 3 kinds of data:

- Use of the digital tool: evaluation of the activity and usage of the tools (mainly quantitative evaluation)
- Quality of experience: evaluation of the user quality of the experience (mainly qualitative evaluation)
- Pedagogical outcome: evaluation of the progress that is achieved by the students regarding the pedagogical objectives that have been defined.

These data can be collected by different means, including in app data and log automatically collected by the VR and the mobile applications, questionnaires and surveys submitted to the users, interviews and any others evaluation mode.

8.1 DIGITAL ACTIVITY

The objective here is to collect data relating to the users and how they use the digital tools, e.g. the number of connections, the duration of the sessions and the actions performed during the sessions, the progress. These can be collected directly from the tool (in-app data and log) or not. We describe here after data that can be collected from the VR activities and from the mobile activities. In both cases, we may distinguish between the teachers and the students, as both groups of users may have specific user journey in the apps.

Mobile is an optional or assisting component of Hotel Academy.

8.1.1 VR

General data collected here will include the number of sessions that will be organized, the number of users that will be connected and the duration of the sessions, the number of connection problems encountered.

In addition, more specific data may be collected, relating to the actions and the interactions that will be performed in the VR environment. At the moment, the VR application is currently being designed, so it is not possible yet to define the in-app statistics that will be available. We will examine the possibilities based on the interactions and functionalities that will be developed.

These data can be analysed in combination with the visual comfort questionnaire presented in section 8.2.1, for instance, to determine the impact of the session's duration. These may also help to refine the user interface.

8.1.2 MOBILE

- **General statistics**

They can be divided into 3 types:
- CONNECTION STATISTICS: how many users are registered, unique visitors, number of visits, etc.
- ACTIVITY STATISTICS: number of activities available, type of activity, average of activities carried out, most used activities, etc.
- COMPLETION STATISTICS: distribution of users by completion rate, average success rate for each type of activity, by theme, reading rate of articles and videos by theme, etc.

Detail of connection statistics

The connection statistics allow to find out more about the frequency of use of the application and its adherence by the targeted persons.
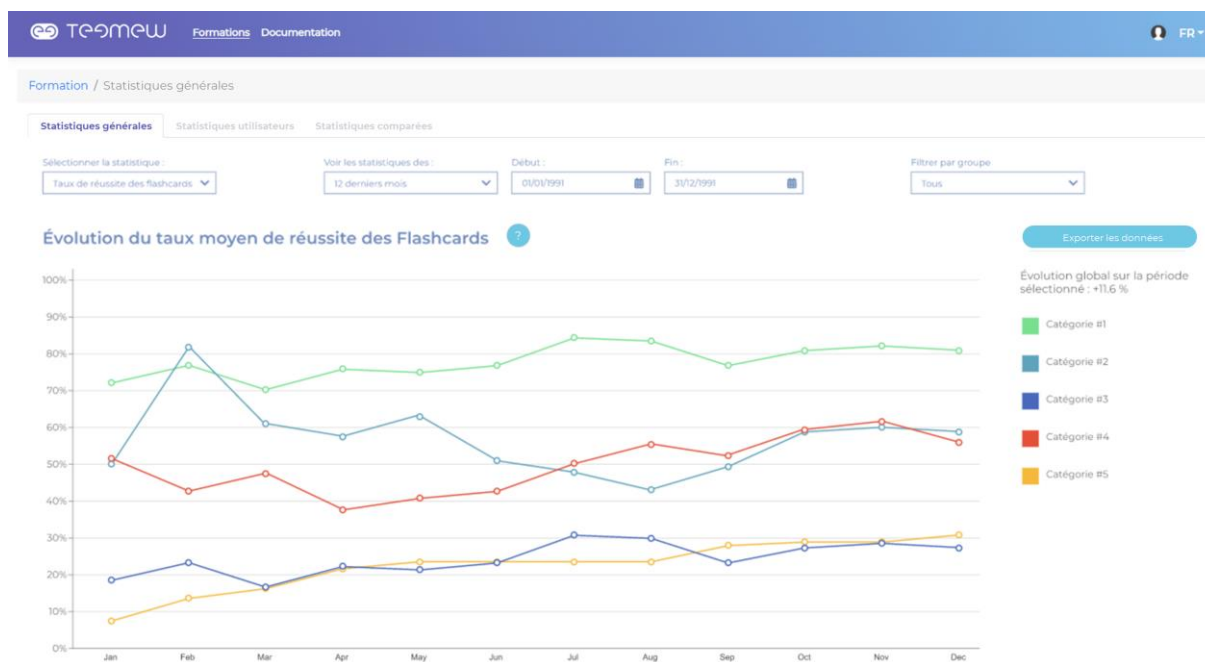
The connection statistics are:
- Number of people registered for training
- Total unique connections (= unique visitors)
- Average number of unique connections per day
- Total connections (= visits)
- Average connections for an average user

Detail of activity statistics

Activity statistics allow to control the training content and its consumption, in order to know when to add more, which are the most appetizing for the user, etc.

The activity statistics are:

- Number of activities available, by type of activity
- Maximum number of activities performed by a user, by type of activities
- Average number of activities performed per user, by type of activities
- Overall average of activities carried out
- Detail of the most used activities

Detail of completion statistics

Finally, the completion statistics make it possible to monitor training performance and highlight potential user difficulties on certain subjects.

The completion statistics are:

- Distribution of users by completion rate, by category
- Average category completion rate
- Average flashcard success rate, by category
- Overall evolution of the flashcard success rate
- Average success rate of mini-games, by category
- Overall evolution of the success rate of mini-games
- Average reading rate of articles and videos, by category
- Overall change in the reading rate of articles and videos

- **User Statistics**

The administrator can search and select one of his users to consult his statistics, namely:

- Connection frequency
- Progression in each of the themes
- Most used activities
- Success scores at events (quizzes, journeys)
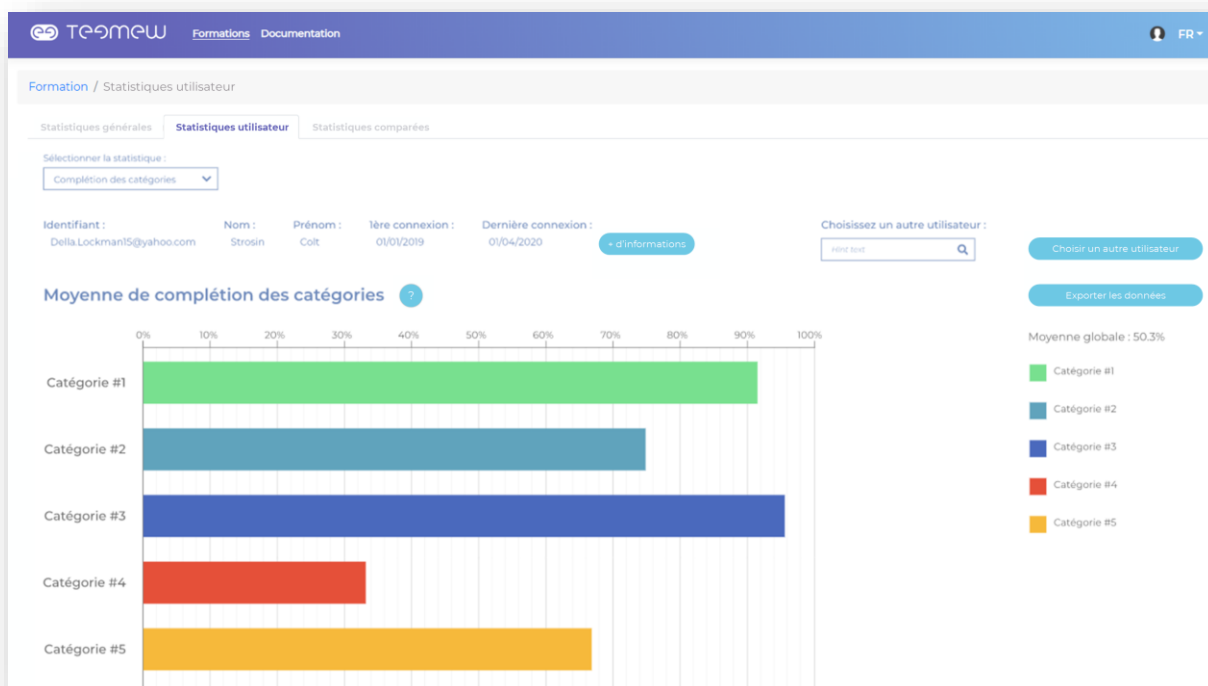
▪ Compared Statistics

Via the compared statistics, the administrator can compare two to four different user groups.

For example, this can be used to compare the performance of one school against another, or against all users.

The statistics available for comparison are:

- category completion
- the success rate of events
- event participation rate
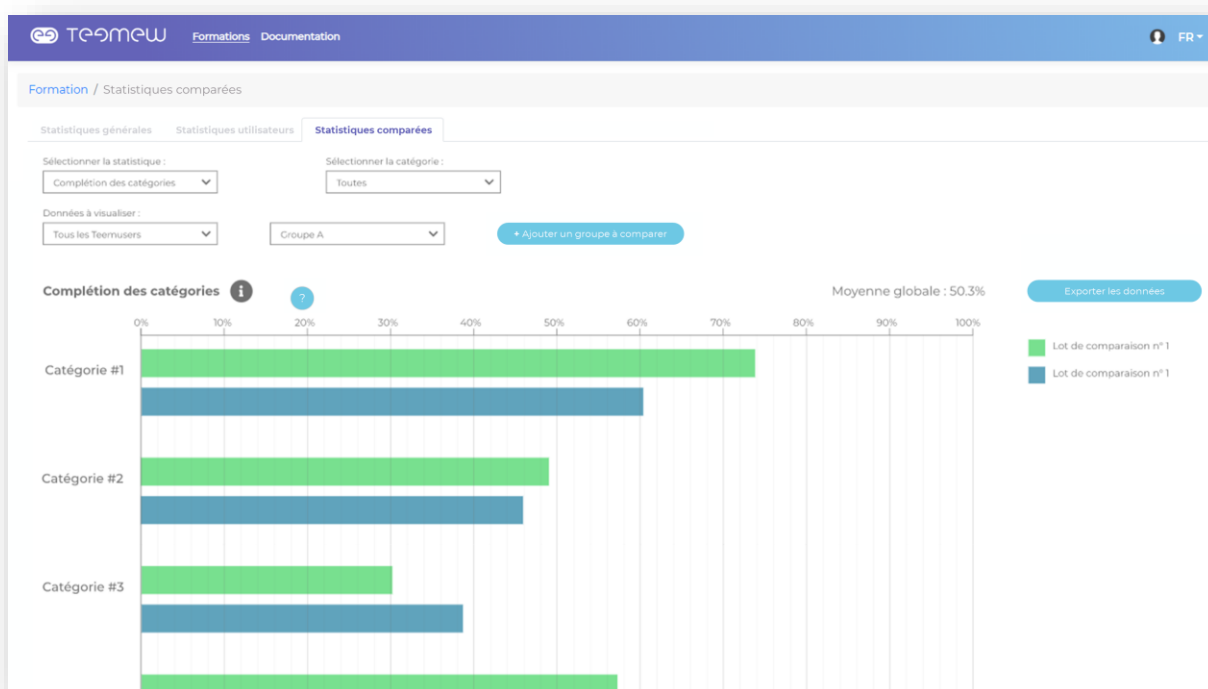
■ **Profile**

By clicking on his profile, the user has access to various secondary, non-pedagogical functionalities: badges and honours, summary of his progress, his leaderboard.

The pedagogical interest of this feature is to personalize and gamify the experience. Via this access, the user can also change a few settings, including his profile picture.

When a condition is met, the user earns a badge. Badges encourage the user to invest in the application. They reward and value the user.

In addition, when a certain number of points is reached, the user unlocks an honour, an "honorary title", linked to the mythology set up in Teemew. The user can then choose from the different awards available to personalise their profile and compare themselves to other learners. This gamifies the gain of points, thus encouraging recurring use.

■ **Leaderboard**

The leaderboard allows to value the users and to highlight the most assiduous. The user can thus evaluate his position and his points in relation to the others.

The leaderboard can be global (all users), by organization (declared by the administrator, different schools for instance – so all users of the same school) and by function (all users with the same education level / function, for instance master / bachelor, student / teacher).

This values the best users and challenges the others, giving them a goal to surpass.

For the time being, we have not yet discussed the organization of groups within the different partners organizations. We assume that all schools will constitute only one group, but this can of course evolve with the definition of the course schedule.

Concerning the use of the leaderboard, ESG envisages to use it to determine the students who will go first into the VR experience. However, FHD and EUC prefer to keep the activity less competitive and rather concentrate on the students' experience.
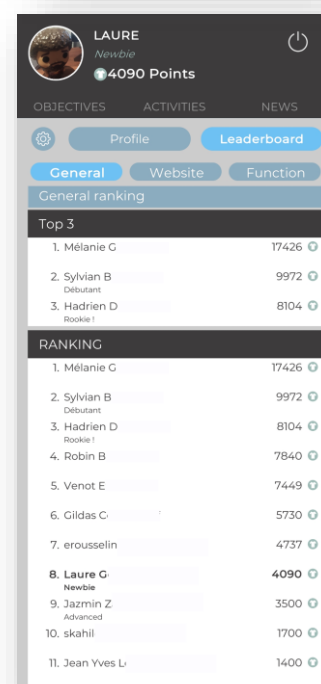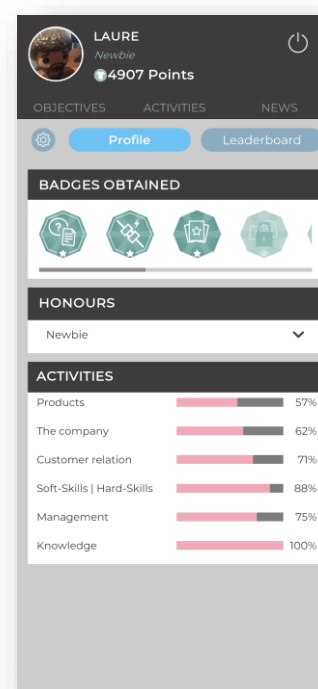
8.2 QUALITY OF EXPERIENCE

8.2.1 Questionnaire

- **The parameters analysed**

In order to collect feedback from users about the quality of experience (QoE), we will use a questionnaire from previous experiments carried out by Manzavision (Souchet et al, 2020), so that results can be comparable.

This questionnaire is divided into 4 sections, some of which will be used to specifically evaluate the experience of VR sessions:

- User experience (UX)
- Visual comfort
- Flow
- Presence

The questions are drawn from previous studies:

The self-assessment questionnaire used to evaluate the User eXperience (UX) is the abbreviated version of the **User Experience Questionnaire (UEQ)**. The UEQ was developed in 2008 by Laugwitz, Held and Schrepp and is based on the theoretical model proposed by **Hassenzahl** to explain the perceived quality of an interactive system. It may be used for VR and non-VR experience.

The **Flow** and **Presence** questionnaires are taken from scientific studies on the subject. "Multimodal Presence Scale" by Makransky et al; "Flow Short Scale" by Rheinberg, Vollmeyer and Engeser; Visual comfort by Zeri and Livi.

The complete questionnaire is presented in Annexe 11.1.

- **The User experience questionnaire**

The Principle

The abbreviated version of the UEQ includes 8 items to measure the pragmatic and hedonic qualities of a system:

- **Pragmatic qualities** refer mainly to the instrumental aspects of the system or product, i.e. its utility and usability. These pragmatic qualities will support the achievement of objectives or tasks (called *do-goal*). Clarity of the system, its structure or predictability are all attributes related to pragmatic quality.
- **Hedonic qualities**, on the other hand, are non-instrumental and refer to the self. They are linked to the user and are based on a judgement of the product's potential to provide pleasure and to satisfy deeper human needs called *be-goals*. The ability of the system to stimulate the user, to connect him/her to others, to give him/her a sense of control or to confer popularity are all attributes related to hedonic quality.

The questions are based on a scientifically validated framework (https://www.ueq-online.org), covering 6 criteria:

- Attractiveness: General impression of the product. Do users like it or not?
- Insight: Is it easy to become familiar with the product and learn how to use it?
- Efficiency: Can users solve their tasks without unnecessary effort? Does it react quickly?
- Reliability: Does the user feel in control of the interaction? Is it secure and predictable?
- Stimulation: Is the use of the product exciting and motivating? Is it fun to use?
- Novelty: Is the product design creative? Does it appeal to users?

The results of this questionnaire

The averages of the pragmatic and hedonic quality scales can be interpreted as follows:

- Values between -0.8 and 0.8 represent a neutral evaluation of the corresponding scale
- Values > 0.8 represent a positive assessment

- Values < -0.8 represent a negative assessment

The range of scales is between -3 (terrible) and +3 (extremely good). But in real applications, in general, only values within a restricted range will be observed. This is due to averaging over a range of different people with different opinions and response patterns, for example avoiding extreme response categories, which are extremely unlikely to observe values above +2 or below -2.

Robustness of results and confidence interval by item and scale

The 5% confidence intervals for the scale averages and the averages of the individual items are given here. The confidence interval is a measure of the accuracy of the estimate of the average. The smaller the confidence interval, the higher the precision of the estimate and the more confidence you can have in your results. The width of the confidence interval depends on the amount of data available and the consistency with which people have judged the product being evaluated. The more consistent their opinion, the smaller the confidence interval.

Correlation of items by scales and Cronbachs alpha coefficient

Items that belong to the same scale should generally have a high correlation. The alpha coefficient (Cronbach, 1951) is a measure of the consistency of a scale. There is no generally accepted rule for determining the value of the coefficient. Many authors believe that a scale should have an alpha value > 0.7 to be considered sufficiently consistent. However, from a methodological point of view, such a use of a limit is not really justified (see, for example, Schmitt, N., 1996). Especially if you only have a small sample, the alpha value should be interpreted with caution.

If the alpha value of a scale shows a massive deviation from a reasonable target value, e.g. 0.7, this may indicate that some items on the scale are interpreted in the context given by several participants in an unexpected way. In such cases, the corresponding scale should be interpreted with great caution.

8.2.2 User Interview

- **Method description**

The user interview is a method of collecting qualitative data where a team member in contact with a participant asks about the participant's experience, attitudes and behaviours. Interviewing is one of the techniques of UX survey. It allows an in-depth exploration of the respondent's attitudes, opinions, preferences, beliefs, or mental representations.

- **Objectives**

User interviews are conducted to meet several objectives:
- To understand how trainers work
- Have qualitative data on users
- Develop empathy with users

- **Users to be questioned**

The persons to be interviewed must be target users of the Teemew VR product. We have identified several user profiles:
- Trainers
- Course creators
- Planners
- (optional) Students

Note: The questions to be asked during an interview vary depending on the type of user being interviewed. However, some questions will be common.

- **Data to be recovered**
  - Verbatims
  - Feedback and anecdotes
  - Course creation process
  - Course planning process
  - Tool lists used by users

- **Places to conduct interviews**

It is generally preferable to conduct face-to-face interviews in the interviewee's environment. The locations for conducting interviews are, therefore, in order of preference:
1. Universities/Schools
2. Partners premises
3. Telephone/Teams

- **Format**

Semi-directive interview: This is the most common type of format for user interviews. The interview then takes the form of a conversation in which the interviewer covers all the points he or she wishes but allows flexibility in the conversation to explore unanticipated topics.

- **Themes to explore**
  - Virtual Reality and Training
    - How Virtual Reality is perceived by users
    - Is Virtual Reality effective for training?
    - What Virtual Reality material is available in the training course?
  - Creating a course
    - What is the process of creating a training course?
    - Why is training created?
    - What training materials are currently available?
    - What are the points of irritation when a training is created?
    - What are the possible interactions with other trainers or trainings?
  - Training Management
    - Who manages the planning of a training course?
    - How is a training planned?
    - What tools are used for this?
    - What are the points of irritation when planning a training course?

- **Interview Structure**

The interview is structured in 5 phases:
1) **Introduction** (2 to 5 minutes): Welcome the participant, put him/her at ease. Have him/her sign a consent form and ask for permission to record or film (important).
2) **Warm-up** (5-7 min): Explain to the participant the reasons for the interview (introduce yourself if you have not already done so, introduce the project). Then, ask the following questions to put the participant at ease:
   - How old are you?
   - Can you explain in a few words your position and roles within your organization/*university name*
   - Tell me about one of your typical days/activities. What do you do first? What's the next one?
3) **Body of the interview** (~80% of the interview): Start with generic questions then go into detail with specific questions. Don't hesitate to ask questions not included in the list, let the

user tell anecdotes, informalize the exchange so that it looks like a discussion and not a series of questions.

Questions for trainers	• Did you design the course? Did you retrieve it or do you do the training by collaborating with the creator of the training? • *(If he created the training)* What are your goals when creating a course? • Can you show me or tell me how you design a course? • Can you list the tools you use/have used to create your course? • What is the worst experience you have had while creating a course? • Who manages the organization/planning of the courses?
Question for planners	• Who decides who attends a course? • How does the planning of a course/training take place? • Can you list the tools you use to plan courses? • What are your points of irritation in course planning? • Have you ever taken a course taught by a trainer from your organization?
Generic Questions	• When I say "Virtual Reality", what do you think about? • What will Virtual Reality look like in 10 years in the best scenario? • How did you perceive the use of Virtual Reality in training? • In your opinion, how is Virtual Reality perceived in training? • Does your organization/*university name* have Virtual Reality equipment?

4) **Retrospective** (5 min): Back to generic questions:
- On a scale of 1 to 5, how familiar are you with Virtual Reality equipment?

   Summarize the interview and see if the participant insists on a point or gives additional information.

5) **Closing** (3 min): If the participant has nothing to add, thank him/her and close the interview.

8.2.3 Surveys

Users are asked a question, with different choices of answers defined. The user can then vote anonymously for the answer they prefer. Once he has given his opinion, he can consult the distribution of other users' answers.

The survey creates interaction between the learner and his or her trainer, thus strengthening the human link and the commitment of the user.

8.2.4 Quizzes

A series of multiple-choice questions is asked to the user on a given topic and at a defined date. As soon as a question is answered, the user immediately sees the correction with the correct answer(s). A comment can also be added to give further explanation.

At the end of the quiz, an assessment page summarizes the user's performance on the quiz.

The pedagogical interest of this activity is to test the knowledge acquired. The correction is present after each question, which breaks the rhythm and evaluates what has been learned.

Not linked to a category, the quiz allows to cross-reference themes or, on the contrary, to propose an "out-of-category" test, linked to a key moment in class or within the organization.

8.3 PEDAGOGICAL OUTCOME

The objective in this section is to evaluate the learning experience from the pedagogical point of view: did the students achieved progress toward the learning goal that has been defined? At the time of reporting, the course concept is still in progress. Since the course concept describes the methods and technologies used, the provision of an evaluation concept was not (yet) possible. This will therefore take place in the further course of the project parallel to the development of the course concept. However, the evaluation concept will be based on the Kirkpatrick's framework, by which course evaluation focuses on four different dimensions:

1. Reaction - The degree to which students find the course in Hospitality Management favorable, engaging and relevant to their jobs
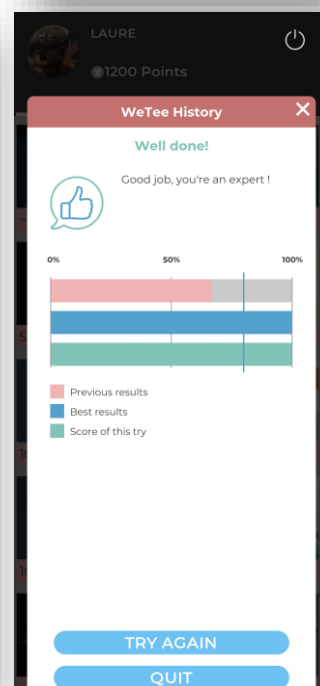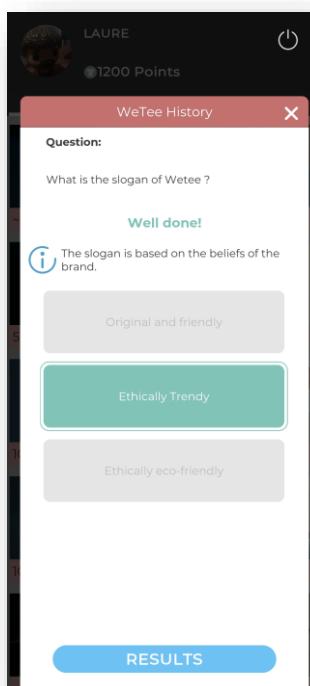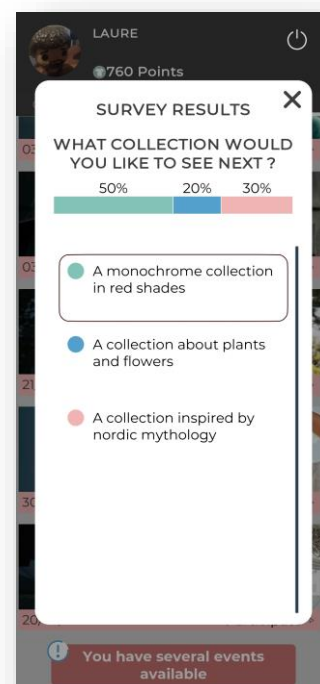
2. Learning - The degree to which students acquire the intended knowledge, skills, attitude, confidence and commitment based on their participation in the course
3. Behavior - The degree to which students apply what they learned during course when they are back on the job in Hospitality sector
4. Results - The degree to which targeted outcomes occur as a result of the training and the support and accountability package

We plan to include the first three dimensions (reaction, learning and behavior) in our evaluation framework.

9 OUTLOOK

The didactic framework for the Hotel Academy project was gradually developed over the first months of the project and discussed with the project partners. With the completion of work package IO1, a conceptual basis is available for the development of the educational scenario in hospitality management. However, the work on the didactic framework is not finished. Rather, this should also be validated by expert interviews in the coming months. In addition, the experience gained from the implementation of the project, including the use of ML, VCL and VRL, should be gradually incorporated into ongoing in order to ensure knowledge transfer beyond the project duration. The following Figure 3 shows the further planned steps for the systematic expansion of the framework within the project duration. The framework will be shared with the Advisory board for additional feedback.

Version 1
- Literature Review (Nov19-Jan20)
- Discussion on TNM

Version 2
- Literature Review (Mar20-May20)
- Discussion on TNM
- Report IO1

Version 3
- Expert Interviews (Jun20-Aug20)
- Discussion on TNM

Version 4
- internal Group Discussion (...)
- Presentation on TNM
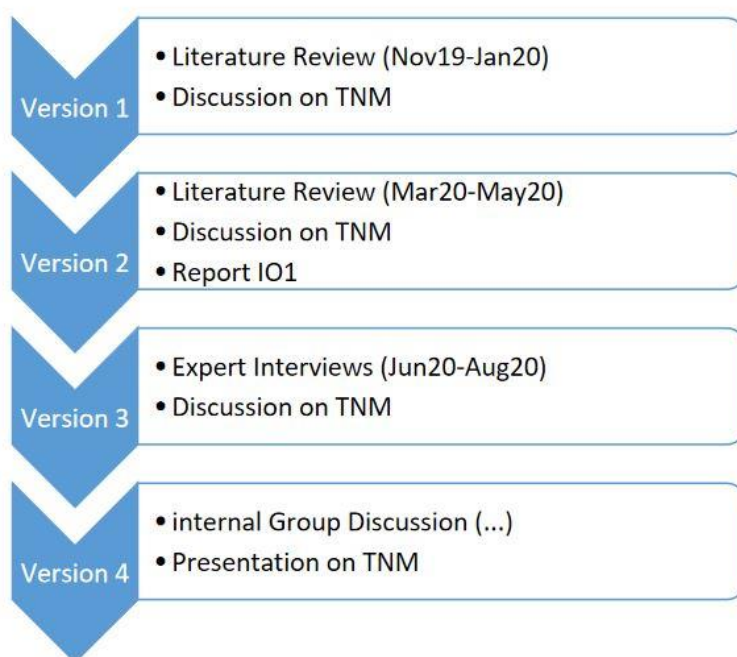
Figure 3: Planned steps for the systematic expansion of the framework within the project duration

The presentation of the refined framework based on literature review raised the following comments from Project partners:

MZV: Cost savings in traveling provides added value, i.e. connecting distant people. Also, contents presented in VR allow the use of simulation or showing things not easily to do in real life.

FHD: VR locomotive aspect, students' movements. This is an advantage in scientific fields where is necessary to see and feel. For connecting people, other tools are available and less expensive.

MZV: About Mobile Learning, Bring Your Own Device (BYOD): how do you implement such a strategy? Is it easy to ask students and teachers to use their personal device? Is it already in practice?

FHD: There are 2 options: Universities buy equipment and hand out to students, or BYOD which implies data security problems, students should not bring the information out of context.

About the practice, we have created applications and students download them, it is working but it is an open issue. It makes digitalization more affordable; it came up as a Coronavirus crisis solution, but universities should make an investment on it.

ESG: We do not implement mobile learning for security reasons, we have distance learning.

EUC: Mobile learning with students' devices and VR learning with headsets represent a problem about how to use them in class.

FHD: The framework works together as one system; you cannot separate them. To solve the VR headsets problem is a didactic question, you can divide the lesson in 2 groups.

10 REFERENCES

Literature used for the evaluation of the concept / didactic framework

Euler D. and Seufert S. (2005) Change Management in Higher Education: Implementation of e-Learning as a Sustainable Innovation

Black, Paul and Wiliam, Dylan (1998): "Assessment and Classroom Learning", Assessment in Education: Principles, Policy & Practice, 5:1, 7-74
http://dx.doi.org/10.1080/0969595980050102

Euler, Dieter and Seufert, Sabine (2005): Fallstudie Universität Basel. Tübingen
https://www.e-teaching.org/projekt/fallstudien/uni_basel/fallstudie-basel.pdf

Souchet A., Drapier O., Granier de Cassagnac R., Maurice E., Azouani R., Zaza E., Naudot N., Charron V., Risetti A., Hono J., Philippe S.; Virtual Classroom's Quality of experience: a collaborative VR platform tested in situ; published in Richir S. (2020). ConVRgence (VRIC) Virtual Reality International Conference Proceedings. International Journal of Virtual Reality.
https://doi.org/10.20870/IJVR.2020.3316

G. Makransky, L. Lilleholt, et A. Aaby, "Development and validation of the Multimodal Presence Scale for virtual reality environments: A confirmatory factor analysis and item response theory approach", Computers in Human Behavior, vol. 72, p. 276–285, 2017.
Doi: 10.1016/j.chb.2017.02.066

S. Engeser et F. Rheinberg, "Flow, performance and moderators of challenge-skill balance", Motivation and Emotion, vol. 32, n° 3, p. 158–172, 2008.
Doi: 10.1007/s11031-008-9102-4

F. Zeri et S. Livi, "Visual discomfort while watching stereoscopic three-dimensional movies at the cinema", Ophthalmic and Physiological Optics, vol. 35, nᵒ 3, p. 271–282, 2015.
Doi: 10.1111/opo.12194

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16, 297–334.

Schmitt, N. (1996) Uses and Abuses of Coefficient Alpha. Psychological Assessment, 8, 350-353.

Literature (excerpt) used for compiling the data regarding the guidelines on VRL and ML

1. A meta-analysis of virtual reality training programs for social skill development (2019)

https://www.sciencedirect.com/science/article/abs/pii/S036013151930260X

Computers & Education – Volume 144, January 2020, 103707

Author(s): Matt C. Howard (a), Melissa B. Gutworth (b)

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(b) Feliciano School of Business, Montclair State University, 1 E. Normal Ave., Rm. 455, Upper Montclair, NJ, 07043, United States

2. Augmented virtual reality: How to improve education systems (2017)

https://www.researchgate.net/publication/318615917_Augmented-Virtual_Reality_How_to_improve_education_systems

Higher Learning Research Communications, 7(1), 1–15.

http://dx.doi.org/10.18870/hlrc.v7i1.373

Author(s): Manuel Fernandez (a) (a) Universidad Europea de Madrid, Madrid, Spain

3. Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis (2014)

https://www.sciencedirect.com/science/article/abs/pii/S0360131513002108?via%3Dihub

Computers & Education – Volume 70, January 2014, Pages 29-40

Author(s): Zahira Merchant (a), Ernest T. Goetz (b), Lauren Cifuentes (c), Wendy Keeney-Kennicutt (d), Trina J. Davis (a)

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(c) Department of Distance Learning, Texas A&M University, Corpus Christi, TX 78412, USA

(d) College of Science, Department of Chemistry, Texas A&M University, College Station, TX 77843-3225, USA

4. The Effect of Three Dimensional Virtual Environments and Augmented Reality Applications on The Learning Achievement: A Meta-Analysis Study (2019)

https://search.proquest.com/openview/ab2e72e2975d5ccac4a2b262d4cc1f69/1?pq-origsite=gscholar&cbl=1056401

Egitim ve Bilim (Education and Science); Ankara Bd. 44, Ausg. 198, (2019).

Author(s): Şirin Küçük Avcı (a), Çoklar, Ahmet Naci (b), Aslıhan İstanbullu (c).

(a) Akdeni z University, Faculty of Education, Department of Education Sciences, Turkey

(b) Necmettin Erbakan University, Ahmet Keleşoğlu Education Faculty, Department of Computer and Instructional Technology Education, Turkey

(c) Amasya University, Vocational High School of Technical Science, Department of Information Technology, Turkey

5. Examining the Effectiveness of Augmented Reality Applications in Education: A Meta-Analysis (2016)

https://files.eric.ed.gov/fulltext/EJ1118774.pdf

INTERNATIONAL JOURNAL OF ENVIRONMENTAL & SCIENCE EDUCATION 2016, VOL. 11, NO. 16, 9469-9481

Author(s):

Hakan Tekedere (a), Hanife Göker (a)

(a) Gazi University, TURKEY

6. Factors Associated With Virtual Reality Sickness in Head-Mounted Displays: A Systematic Review and Meta-Analysis (2020)

https://www.frontiersin.org/articles/10.3389/fnhum.2020.00096/full

Front. Hum. Neurosci. 14:96. doi: 10.3389/fnhum.2020.00096

Author(s): Dimitrios Saredakis (a), Ancret Szpak (a), Brandon Birckhead (b), Hannah A. D. Keage (a), Albert Rizzo (c) and Tobias Loetscher (a)

(a) Cognitive Ageing and Impairment Neurosciences Laboratory, School of Psychology, Social Work and Social Policy, University of South Australia, Adelaide, SA, Australia

(b) Division of Health Services Research, Department of Medicine, Cedars-Sinai Health System, Los Angeles, CA, United States

(c) Institute for Creative Technologies, University of Southern California, Los Angeles, CA, United States

7. Learning in Virtual Worlds (2016)

https://eprints.usq.edu.au/28739/21/Gregory_etal_2016_FrontMatter_PV.pdf

Issues in distance education, 1919-4382)

Published by AU Press, Athabasca University 1200, 10011 – 109 Street, Edmonton, AB T5J 3S8

Author(s): edited by Sue Gregory, Mark J. W. Lee, Barney Dalgarno, and Belinda Tynan

8. Blended Learning Using Virtual Reality Environments (2017)

https://www.iasj.net/iasj?func=fulltext&aId=125794

Iraqi Journal for Computers and Informatics (IJCI), 6, Vol. [43] Issue[1] 2017

Blended Learning Using Virtual Reality Environments

Author(s):

Jane Jaleel Stephan (a), Ahmed Shihab Ahmed (a), Alaa Hamza Omran (a)

(a) University of Information Technology and Communications

9. How does desktop virtual reality enhance learning outcomes? A structural equation modeling approach (2010)

https://www.sciencedirect.com/science/article/abs/pii/S0360131510001661?via%3Dihub

Computers & Education

Volume 55, Issue 4, December 2010, Pages 1424-1442

Author(s): Elinda Ai-Lim Lee (a) (b), Kok Wai Wong (a), Chun Che Fung (a)

(a) School of Information Technology, Murdoch University, South St, Murdoch 6150 Western Australia, Australia

(b) Faculty of Computer & Mathematical Sciences, MARA University of Technology Sarawak, Jln Meranek, 94300 Kota Samarahan, Sarawak, Malaysia

10. Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach (2010)

https://www.sciencedirect.com/science/article/abs/pii/S0360131510001466?via%3Dihub

Computers & Education – Volume 55, Issue 3, November 2010, Pages 1171-1182

Author(s): Hsiu-MeiHuang (a), Ulrich Rauch (b), Shu-Sheng Liaw (c)

(a) Department of Information Management, National Taichung Institute of Technology, 129, Sec. 3, Saming Rd., Taichung 404, Taiwan

(b) The Learning Centre (TLC@UTT), University of Trinidad and Tobago, O'Meara Industrial Park, Arima, Trinidad, WI, USA

(c) General Education Center, China Medical University, 91 Shiuesh Rd., Taichung 404, Taiwan

11. The Use of Immersive Virtual Reality in the Learning Sciences: Digital Transformations of Teachers, Students, and Social Context (2008)

https://www.tandfonline.com/doi/pdf/10.1080/10508400701793141

Journal of the Learning Sciences, 17:1, 102-141, DOI: 10.1080/10508400701793141

Author(s): Jeremy N. Bailenson, Nick Yee, Jim Blascovich, Andrew C. Beall, Nicole Lundblad & Michael Jin

12. The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis (2016)

https://www.sciencedirect.com/science/article/pii/S0360131515300804

Computers & Education – Volume 94, March 2016, Pages 252-275

Author(s):
Yao-TingSung (a), Kuo-EnChang (b), Tzu-ChienLiu (a)

(a) Department of Educational Psychology and Counseling, National Taiwan Normal University, Taiwan, ROC

(b) Grad. Institute of Information and Computer Education, National Taiwan Normal University, Taiwan, ROC

13. A Research about Mobile Learning Perspectives of University Students who have Accounting Lessons (2014)

https://www.sciencedirect.com/science/article/pii/S1877042814002110

Author(s):

Filiz Angay Kutluk (a), Mustafa Gülmez (b)

(a) Akdeniz University, Ayşe Sak School of Applied Sciences, 07190 Antalya, Turkey

(b) Akdeniz University, Faculty of Tourism, Dumlupınar Bulvarı, Kampus, 07058 Antalya, Turkey

14. Survey Paper on Mobile Learning and Education (2015)

https://www.researchgate.net/publication/276202844_Survey_Paper_on_Mobile_Learning_Education

Author(s):
Adnan Majeed (a)

(a) Hajvery University, Dept of Computer Sciences & Engineering Gulberg, Lahore, Pakistan

15. An Investigation of Effectiveness of Mobile Learning Apps in Higher Education in India (2017)

https://www.researchgate.net/publication/319187545_An_Investigation_of_Effectiveness_of_Mobile_Learning_Apps_in_Higher_Education_in_India and

https://www.academia.edu/34129434/An_Investigation_of_Effectiveness_of_Mobile_Learning_Apps_in_Higher_Education_in_India

Author(s):
Mohd Shoaib Ansari (a), Aditya Tripathi (b)

(a) Govt. Kaktiya PG College, Jagdalpur (Bastar), Chhattisgarh, India

(b) Department of Library & Information Science, Banaras Hindu University, Varanasi, Uttar Pradesh, India

16. Are You Ready for Mobile Learning? Frequent use of mobile devices does not mean that students or instructors are ready for mobile learning and teaching (2007)

https://er.educause.edu/articles/2007/4/are-you-ready-for-mobile-learning

Author(s):

Joseph-Rene Corbeil (a), Maria Elena Valdes-Corbeil (a) (b)

(a) University of Texas, Brownsville

(b) Texas Southmost College

17. A Review of Research on Mobile Learning in Teacher Education (2014)

https://www.researchgate.net/publication/267337349_A_Review_of_Research_on_Mobile_Learning_in_Teacher_Education

Author(s):
Evrim Baran (a)

(a) Middle East Technical University, Faculty of Education, Department of Educational Sciences, Ankara, Turkey

18. A critical review of mobile learning integration in formal educational contexts (2018)

https://www.researchgate.net/publication/323782132_A_critical_review_of_mobile_learning_integration_in_formal_educational_contexts

Author(s):

Luís Pedro (a), Cláudia Barbosa (b), Carlos Santos (a)

(a) University of Aveiro

(b) Institute of Telecommunications

19. Developing a typology of mobile apps in higher education: A national case-study (2017)

https://www.academia.edu/31900225/Developing_a_typology_of_mobile_apps_in_higher_education_A_national_case-study_2017_?email_work_card=abstract-read-more

Australasian Journal of Educational Technology, 2017, 33(4).

Author(s):

Katya (Ekaterina) Pechenkina (a)

(a) Swinburne University of Technology, Australia

20. Review of trends from mobile learning studies: A meta-analysis (2012)

https://www.sciencedirect.com/science/article/abs/pii/S0360131512000735

Computers & Education – Volume 59, Issue 2, September 2012, Pages 817-827

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21. Review of Mobile Learning Trends 2010-2015: A Meta-Analysis (2017)

https://www.researchgate.net/publication/315696935_Review_of_Mobile_Learning_Trends_2010-2015_A_Meta-Analysis

Educational Technology & Society. 20. 113-126.

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11 ANNEXES

11.1 THE USER EXPERIENCE QUESTIONNAIRE (UEQ)

The complete questionnaire is presented below.

User questionnaire

In order to improve our product, we need your feedback.

Please be honest as much as possible. This questionnaire is not here to please or displease experimenters. Focus on your feelings during and after the training session.

It is your personal opinion that counts.

Remember that there are no right or wrong answers!

It will take you about 10 minutes to complete this questionnaire.

Thank you for your participation!

Profile

You are

O   A man   O   A woman   O   Other

How old are you? _____

Are you familiar with VR equipment, including Oculus Go, Oculus Quest, HTC Vive Playstation VR, Samsung Gear VR, etc.?

                1   2   3   4   5

Not at all O O O O O Strongly

Do you own a VR equipment?

O   yes   O   no

Have you already used a VR equipment before?

O   yes   O   no

If yes, how many hours have you already spent in VR environment?

_____

USER EXPERIENCE

The following section consists of pairs of contrasting attributes that may apply to the product. The circles between the attributes represent gradations between the opposites. You can express your agreement with the attributes by ticking the circle that most closely reflects your impression.

Please decide spontaneously. Don't think too long about your decision to make sure that you convey your original impression.

It is your personal opinion that counts. Please remember: there is no wrong or right answer!

Is the product obstructive or supportive?

              1   2   3   4   5   6   7

Obstructive O O O O O O O Supportive

Is the product complicated or easy?

              1   2   3   4   5   6   7

Complicated O O O O O O O Easy

Is the product inefficient or efficient?

              1   2   3   4   5   6   7

Inefficient O O O O O O O Efficient

Is the product confusing or clear?

              1   2   3   4   5   6   7

Confusing O O O O O O O Clear

Is the product boring or exciting?

              1   2   3   4   5   6   7

Boring O O O O O O O Exciting

Is the product not interesting or interesting?

              1   2   3   4   5   6   7

Not interesting O O O O O O O Interesting

Is the product conventional or inventive?

              1   2   3   4   5   6   7

Conventional O O O O O O O Inventive

Is the product usual or leading edge?

	1	2	3	4	5	6	7	
Usual	O	O	O	O	O	O	O	Leading edge

VISUAL COMFORT

This part of the questionnaire aims to assess how your eyes feel after using VR.

To what extent your eyes burn?

	1	2	3	4	5	
Not at all	O	O	O	O	O	Strongly

To what extent your eyes ache?

	1	2	3	4	5	
Not at all	O	O	O	O	O	Strongly

To what extent your eyes strain?

	1	2	3	4	5	
Not at all	O	O	O	O	O	Strongly

To what extent your eyes are irritated?

	1	2	3	4	5	
Not at all	O	O	O	O	O	Strongly

To what extent your eyes are tearing?

	1	2	3	4	5	
Not at all	O	O	O	O	O	Strongly

To what extent your eyes see blurry?

	1	2	3	4	5	
Not at all	O	O	O	O	O	Strongly

To what extent your vision is doubled?

	1	2	3	4	5	
Not at all	O	O	O	O	O	Strongly

To what extent your eyes are dry?

	1	2	3	4	5	
Not at all	O	O	O	O	O	Strongly

To what extend your head aches?

	1	2	3	4	5	
Not at all	O	O	O	O	O	Strongly

To what extent your head aches?

	1	2	3	4	5	
Not at all	O	O	O	O	O	Strongly

To what extend do you feel nauseous?

	1	2	3	4	5	
Not at all	O	O	O	O	O	Strongly

PRESENCE

This section aims to assess how you were feeling during the VR experience.

The virtual environment seemed real to me

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

I had a sense of acting in the virtual environment, rather than operating something from outside

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

My experience in the virtual environment seemed consistent with my experiences in the real world

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

While I was in the virtual environment, I had a sense of "being there"

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

I was completely captivated by the virtual world

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

I felt like I was in the presence of another person in the virtual environment

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

I felt that the people in the virtual environment were aware of my presence

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

The people in the virtual environment appeared to be sentient (conscious and alive) to me

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

During the simulation there were times where the computer interface seemed to disapear, and I felt like I was working directly with another person

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

I had a sense that I was interacting with other people in the virtual environment, rather than a computer simulation

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

I felt like my virtual embodiment was an extension of my real body within the virtual environment

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

When something happened to my virtual embodiment, it felt like it was happening to my real body

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

I felt like my real arm was projected into the virtual environment through my virtual embodiment

                      1   2   3   4   5

Strongly disagree O O O O O Strongly agree

During the simulation, I felt like my virtual embodiment and my real body became one and the same

	1	2	3	4	5	
Strongly disagree	O	O	O	O	O	Strongly agree

FLOW

This section aims to assess how your were feeling during the VR experience.

I felt just the right amount of challenge

	1	2	3	4	5	
Strongly disagree	O	O	O	O	O	Strongly agree

My thoughts/activities ran fluidly and smoothly

	1	2	3	4	5	
Strongly disagree	O	O	O	O	O	Strongly agree

I didn't notice time passing

	1	2	3	4	5	
Strongly disagree	O	O	O	O	O	Strongly agree

I had no difficulty concentrating

	1	2	3	4	5	
Strongly disagree	O	O	O	O	O	Strongly agree

My mind was completely clear

	1	2	3	4	5	
Strongly disagree	O	O	O	O	O	Strongly agree

The right thoughts/movements occurred of their own accord

	1	2	3	4	5	
Strongly disagree	O	O	O	O	O	Strongly agree

I knew what I had to do each step of the way

	1	2	3	4	5	
Strongly disagree	O	O	O	O	O	Strongly agree

I felt that I had everything under control

	1	2	3	4	5	
Strongly disagree	O	O	O	O	O	Strongly agree

I was completely lost in thought

	1	2	3	4	5	
Strongly disagree	O	O	O	O	O	Strongly agree

FREE ANSWER

If you want to share other things about your feelings.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____